SYSTEM AND METHOD FOR SEALING PROSTHETIC SOCKET

BACKGROUND

In prosthetics, an amputee normally dons a prosthetic device by inserting his/her residual limb into a socket portion of the prosthesis. Often, an amputee first places a prosthetic liner over the residual limb, after which the residual limb is inserted into the prosthetic socket, the prosthetic liner acting at least as a cushioning interface between the limb and socket. One example liner is the Alpha® Liner series of prosthetic liners from the Ohio Willow Wood Company in Mt. Sterling, Ohio.

Regardless of the selected limb preparation, the prosthesis must be securely retained on the residual limb in order to permit proper prosthesis function and amputee comfort. Often, in the case of vacuum suspension, a liner-covered residual limb is inserted into a prosthetic socket. A suspension sleeve may also be placed over the brim portion of the socket so as to overlie both the socket exterior and a portion of the residual limb (or liner). In this manner, air may be prevented from entering or exiting the socket from the proximal end of the socket, thereby facilitating the creation and maintenance of a vacuum within the socket. A vacuum device can be used to evacuate the socket interior to some desired vacuum level, so that the force of the vacuum holds the prosthetic socket (and prosthesis) on the residual limb.

The ability to generate and maintain a vacuum may be critical in the case of prosthetic vacuum suspension. If an adequate vacuum level cannot be produced within the socket, the associated prosthesis may not be properly secured to the residual limb. If vacuum is lost during use of the prosthesis, the prosthesis may become loose, leading to possible discomfort or malfunction. Adequately sealing a prosthetic socket can be difficult in the case of a below-knee, i.e., trans-tibial, (TT) amputee. However, these difficulties are often compounded in the case of an above-knee, i.e., trans-femoral (TF) amputee.

More specifically, no effective vacuum solutions have been developed for TF amputees. As compared to TT sockets, TF sockets do not have sufficient room above the brim of the socket for sealing to the liner. As a result, the liner must be reflected over the brim of the socket and then sealed to the socket with a sleeve. This technique may not be durable because amputees commonly bump the brim of the socket against hard objects, which may damage the liner and/or the sleeve, which may result in leakage and loss of vacuum. Furthermore, the presence of a bulky sealing sleeve near or in the groin area may be quite uncomfortable to an amputee.

Internal sealing systems have been developed for TF prostheses, but all known systems have unacceptable drawbacks. These drawbacks include, without limitation: that the seal may require an intimate fit to the residual limb and may not be effective if the limb shrinks or moves in such a way as to break the seal; that the seal may reside too low within the socket, and resulting vacuum suspension may thereby concentrate over too small of an area of the residual limb; and that the sealing element may be too restrictive and may need to be fit very carefully to avoid a constricting "tourniquet effect" on the residual limb.

What is needed is an improved vacuum suspension sealing system, especially an improved vacuum suspension sealing system for a TF prosthesis.

SUMMARY

In one embodiment, a socket sealing system is provided, the socket sealing system possibly comprising: a prosthetic socket having a proximal end, an expanded section, and an internal peripheral shoulder; a brim seal having an inner proximal end, an outer proximal end, and a distal end; a removable brim having a distal end; a liner; and a wicking sock; wherein prosthetic socket may be oriented radially outwardly of the outer proximal end of the brim seal, the outer proximal end of the brim seal may be oriented radially outwardly of the removable brim, the removable brim may be oriented radially outwardly of the inner proximal end of the brim seal, the inner proximal end of the brim seal may be oriented radially outwardly of the wicking sock, and the wicking sock may be oriented radially outwardly of the liner; and wherein the brim seal may be reflected about the distal end of the removable brim.

In one embodiment, a method for donning a socket sealing system, the method possibly comprising: providing a residual limb; donning a liner on the residual limb; donning a wicking sock on the residual limb radially outwardly of the liner; donning a brim seal on the residual limb proximal to the wicking sock; donning a removable brim on the residual limb radially outwardly of the brim seal; reflecting the brim seal about a distal end of the removable brim; and inserting the residual limb into a prosthetic socket.

In one embodiment, a distal bypass valve is provided, the distal bypass valve possibly comprising: a release base having an interior channel including a female thread; a release valve body having an interior channel, at least one relief channel, and an external surface having a male thread; a bypass valve having an interior channel; and an O-ring; wherein the male thread of the release valve body may engage the female thread of the release base; and wherein the at least one relief channel may provide a channel for air to travel between the release valve body and the release base.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying figures, which are incorporated in and constitute a part of the specification, illustrate various example systems and methods and are used merely to illustrate various example embodiments. In the figures, like elements bear like reference numerals.

FIG. **1** is an exploded perspective view of an example embodiment of a socket sealing system.

FIG. **2** is a partial sectional view of an example embodiment of a socket sealing system.

FIG. **2**A is an exploded view of the components shown in FIG. **2**.

FIG. **3**A is a perspective view of a liner **334** being donned on a residual limb RL.

FIG. **3**B is a perspective view of a wicking sock **340** being donned on residual limb RL.

FIG. **3**C is a perspective view of a brim seal **314** being donned on residual limb RL.

FIG. **3**D is a perspective view of a removable brim **324** donned on residual limb RL.

FIG. **3**E is a perspective view of brim seal **314** being reflected over removable brim **324** on residual limb RL.

FIG. **3**F is a perspective view of a socket **302** being donned on residual limb RL.

FIG. **3**G is a perspective view of socket **302** donned on residual limb RL.

FIG. **4** is a sectional view of a prior art example embodiment of a socket sealing system.

FIG. **5**A is an exploded perspective view of an example embodiment of a distal bypass valve **512**.

FIG. **5**B is a sectional view of an example embodiment of distal bypass valve **512**.